The influence of Herman Boerhaave

Gillian Hull BA

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During the first forty years of the 18th century the medical school at Leiden University had a worldwide reputation for the quality of its teaching. Herman Boerhaave (1668–1738) worked at Leiden (then spelt Leyden) for most of this period, and was almost entirely responsible for the high standing of the institution at that time. For many years he held simultaneous professorships in medicine, botany and chemistry, and was still teaching clinical medicine up to the time of his death in September, 1738. As a master of bedside teaching Boerhaave can be regarded as the originator of modern medical education[1]. Huge numbers of foreign students went to Leiden to learn from him, the greatest proportion being from Britain. Of these one-third were from Scotland, and such was his influence that Edinburgh Medical School was founded on his ideas. This, in turn, was the model for North America's first faculty of medicine in Philadelphia, and for subsequent colleges across the Atlantic. How did Boerhaave come to be so influential?

After the siege of Leiden in 1575, the townspeople who had successfully stood up to the Spanish were offered a reward by William the Silent, Prince of Orange. They had the choice of the foundation of a university or freedom from taxation for ten years. They chose the former, and Leiden University soon acquired the high reputation it enjoys to this day.

In the 16th century Padua was the centre of medical excellence. Its influence suffered after the Reformation when non-Catholics were excluded from the main college, though one was created for them later[1]. William Harvey (1578–1657) and Richard Mead (1673–1754), a lifelong friend of Boerhaave, both gained their doctorates from Padua. With Latin still the universal language of scholarship, students had a wide choice of European universities. Leiden was attractive in that it offered freedom of religious belief to its students. This certainly influenced the choice of many Britons, as non-Anglicans had been excluded from Oxford and Cambridge since 1662 and were not readmitted until the 19th century[2].

Giovanni Battista da Monte (Montanus), 1488–1551, initiated bedside teaching at Padua. John van Heurne, who had been a student there, introduced the method to Leiden, where he was professor from 1581 until 1601. His son Otto, who inherited his father's Chair, was more successful at implementing this form of teaching, but interest in the method was intermittent in the years before Boerhaave[3]. The clinical teaching sessions took place at the St Caecilia Hospital in two six-bedded wards, one for men and one for women. After Boerhaave's appointment as Professor of Clinical Medicine in 1714, extra galleries had to be built on to accommodate students wishing to experience his unique, exciting teaching. Places were often reserved, with over 100 students attending the sessions every Wednesday and Saturday[2]. He paid great attention to signs and symptoms, and would invite students to come down from the gallery to discuss the patient and his treatment. Leiden also had a long tradition of anatomical teaching, and the dissection of a cadaver in the anatomy theatre was an important event. Boerhaave believed strongly in the value of post-mortem examinations.

SCOTTISH INFLUENCE AT LEIDEN

In 1692 Archibald Pitcairne, 1652–1713 (a founder fellow of the Royal College of Physicians of Edinburgh in 1681) was appointed Professor of Medicine at Leiden. Returning home on holiday after a year, he failed to come back, but this was the beginning of the university's link with Scotland. Boerhaave took a degree in natural philosophy and theology in 1689 before studying medicine, and he may well have heard some of Pitcairne's lectures. Richard Mead certainly studied under Pitcairne at this time[4]. Boerhaave was largely self-taught in medicine, reading extensively the works of Hippocrates, Vesalius and Sydenham. He was a great admirer of Thomas Sydenham's observation at the bedside, and it is said that he always raised his hat when mentioning the English physician[5].

Boerhaave took his MD from Harderwyjk University in July, 1693, and was appointed 'lector' in medicine at Leiden in 1701. From then until his death in 1738, around 650 English-speaking students spent time at Leiden. Patients and visitors would flock to Leiden to hear him at his crowded lectures, which often contained literary references and quotations. He always thanked his audience for their presence during these sessions.

West Carnliath, Strathtay, Perthshire PH9 0PG

BOERHAAVE AS WRITER

In 1707 Boerhaave published his *Institutes*, which set out his teaching in physiology, pathology, symptomatology and therapeutics. His *Aphorisms*, which dealt with his concept of diagnosis and treatment, followed in 1708. These works went into several editions during his lifetime and were translated into many languages including Arabic. They became standard textbooks in European medical schools[4]. Botany and chemistry were an important part of the medical curriculum at Leiden. The Leiden Botanic Garden was founded in 1587 and is one of the oldest in Europe. As Professor of Botany Boerhaave doubled the number of plants and wrote a catalogue of the garden in 1710. He lectured in the gardens from 7am between the months of February and July. He had considerable influence on Linnaeus, who took his MD from Leiden in 1735. Chemistry was Boerhaave's main area of research, and his contribution to modern inorganic chemistry was outstanding[3]. His *Elementa Chemiae* published in 1724 became a classic. He had to resign the chairs of botany and chemistry in 1729 because of increasing ill-health.

EDINBURGH MEDICAL SCHOOL

John Monro, a student of both Padua and Leiden, where he was taught by Pitcairne, was determined that his native Edinburgh should have a medical school modelled on Leiden. His son Alexander (1697–1767) was sent to the Dutch university where, as his father had intended, he was noticed by Boerhaave. In 1726 Alexander, known as Monro Primus, was appointed the first Professor of Anatomy when the Faculty of Medicine in Edinburgh received its charter. Alexander's son and grandson also held the professorship. As at Leiden the Medical School accepted students of any denomination 'without regard to any Distinction of Sect or Party'[6]. Four other professors were appointed in 1726. These were John Rutherford, who introduced clinical teaching, Andrew Plummer as Professor of Chemistry and Materia Medica, and Andrew St Clair and John Innes who taught the Institutes of Medicine or the Theory of Physick. All these men had studied at Leiden. In addition Charles Alston, who became Professor of Botany, was a product of the Dutch university. It is indeed remarkable that a whole Faculty consisted of the students of one man, who saw its foundation during his lifetime[4].

In 1738 Edinburgh Royal Infirmary, designed by William Adam, was begun, with Alexander (Monro Primus) as one of the committee of four supervising the construction of this elegant building[6]. With established bedside teaching, Edinburgh now offered a complete medical education, becoming the country's most respected medical school. Over 100 Americans graduated from the Edinburgh Faculty, before Philadelphia's schools were founded. In 1760 Benjamin Rush, the American physician and teacher, said 'the system of Dr Boerhaave then governed the practice of every physician in Philadelphia'[3]. The following century the Philadelphia medical colleges were described as 'children of Edinburgh and grandchildren of Leyden'. The first Professor of Medicine at St Andrews, Thomas Simpson, appointed in 1722, had studied at Leiden. Thomas Brisbane, who held chairs of anatomy and botany at Glasgow had also studied there. Boerhaave's Edinburgh influence was not restricted to the medical school; between 1702 and 1768 a third of the Fellows of the city's College of Physicians had been his pupils[7]. In Dublin there was a high proportion of Leiden men in the medical school and in the Irish College of Physicians. Four of Boerhaave's pupils became President of the London Royal College of Physicians where twenty eight became Fellows. One notable president was William Pitcairn, a physician at Barts, whose 5-acre botanical garden at his London home was probably based on that of Leiden. Three of Boerhaave's former students became highly acclaimed teachers, among them Nathan Alcock, known for his private anatomy and chemistry lectures at Oxford. Such was his success that he was offered, but refused, a Regius Professorship at the university. In the event the city's first hospital, the Radcliffe Infirmary, was not founded until 1770[7].

HIS ANGLOPHONE STUDENTS

In 1730 Boerhaave was offered Fellowship of the Royal Society, which received its charter in 1662. He never left Holland so was not fully admitted, though he did write papers for the Society's *Philosophical Transactions*, including his treatise on mercury. Forty-five of his ex-pupils became Fellows, seven holding the highest offices of the Society including one President. Four received the Copley medal, which was awarded annually for the most distinguished contribution to scientific knowledge. Under the Presidency of Sir John Pringle, from 1772 to 1778, the Society saw some notable scientific advances by its Fellows. Pringle had gone to Holland to study commerce but the story is that, having heard one lecture by Boerhaave, he decided to study medicine, gaining his MD from Leiden in 1730. He held the Chair of Moral Philosophy in Edinburgh, but moved to London where he was the founder of the Army Medical Service. His most famous work *Observations on Diseases of the Army* was published in 1752, and is known for its humane common-sense[8]. He was physician to George III and other members of the Royal Family, and was one of several former students of Boerhaave to hold royal appointments.

With the 18th century development of the Voluntary Hospital Movement many former pupils were involved in establishing hospitals throughout the country. Alexander Stuart matriculated from Leiden in 1709, having been

recommended to Boerhaave by Hans Sloane, 1660–1753, the highly regarded physician and naturalist. Stuart later wrote to Sloane describing his teacher's great qualities. Back in Britain he became the first physician to Westminster Hospital when it was founded in 1719. He later moved to St George's on its foundation in 1733.

William Oliver, who also spent time in Leiden, was leading physician in Bath, the country's most fashionable watering-place. He played a major role in the creation of the Mineral Water Hospital, and was its chief physician for twenty years[7]. Oliver became a Fellow of the Royal Society. His most important publication was *Practical Essay on the Use and Abuse of Warm Bathing in Gouty Cases*. He is still remembered for an eponymous biscuit whose blandness was thought beneficial for the over-indulged stomachs of the day. When the Prince Regent and the dictates of fashion led the sick to Brighton it was another ex-pupil of Boerhaave and Fellow of the Royal Society, Richard Russell, who argued for the benefits of sea-bathing.

William Hillary, another of Boehaave's former students to work in Bath, mentioned his debt to his teacher in *An inquiry into the Means of improving Medical Knowledge* (1761). He is also remembered for work carried out in his native Yorkshire on a possible correlation between weather and epidemics and for his analysis of the water at Lincomb, near Bath. He spent many years in the West Indies, and *Diseases of Barbados* is one of the first treatises by an Englishman on tropical diseases[9].

SCIENTISTS AND WRITERS

Among ex-students who contributed to scientific knowledge was botanist William Houston, who returned from a visit to Jamaica with plant material for the Chelsea Physic Garden. This was added to the collection already made by Sir Hans Sloane, who had refounded the garden in 1722 for education and research. Boerhaave and Sloane corresponded over many years and Linnaeus, when he came to England, carried a letter of introduction to Sloane from his Leiden teacher. John Huxham was in Leiden in 1715, but spent most of his working life in Plymouth, where he wrote numerous papers for the Royal Society and won the highly respected Copley Medal in 1755 for his *Medical and Chemical Observations on Antimony*. His Fellowship of the Society was awarded for his work on Devonshire colic, which he attributed to tartar in cider apples. Lead-poisoning was later discovered to be the cause. William Brownrigg, awarded an MD from Leiden in 1737, settled in Cumberland where he worked on coal gases in an attempt to reduce mortality among miners. He was awarded the Copley Medal in 1766.

Boerhaave was a man of erudition with a wide knowledge of literature and music. Several former students were known for their literary output; there were poets, travel writers and biographers as well as medical and scientific authors. Mattew Maty was born in France, graduated in Leiden, and settled as a physician in London, where he became Foreign Secretary to the Royal Society in 1762. He participated in the foundation of the British Museum in 1753, and eventually became its principal librarian. He wrote a short biography of his teacher in French. The major biography after Boerhaave's death on 23 September 1738 was written by another of his former students, William Burton, who practised in Yarmouth. Burton was one of many ex-pupils from all over Europe who corresponded with their teacher about difficult cases. His book *An Account of the Life and Writings of Herman Boerhaave* was published in 1743. The affection and enthusiasm Boerhaave inspired in his students is evident throughout, and Burton mentions that despite his carelessness of dress he had 'a distinguishable dignity'. He was known worldwide and once received a letter from China addressed to 'Mr Boerhaave, Europe'.

During the 18th century Boerhaave had remarkable influence, as his students worked throughout the world, gaining academic awards and founding medical schools based on his principles. Some say that Boerhaave had no enduring effect on medical thought because he produced little research[10]. It is, however, as a teacher that he is remembered, and his inspiration undoubtedly urged others to heights of scholarship and academic distinction. Former student Albrecht von Haller, 1708–1777, who founded the medical school at Gottingen in 1736, said he was 'filled with unbelievable delight when I heard him explain for the first time the true medicine'[11].

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